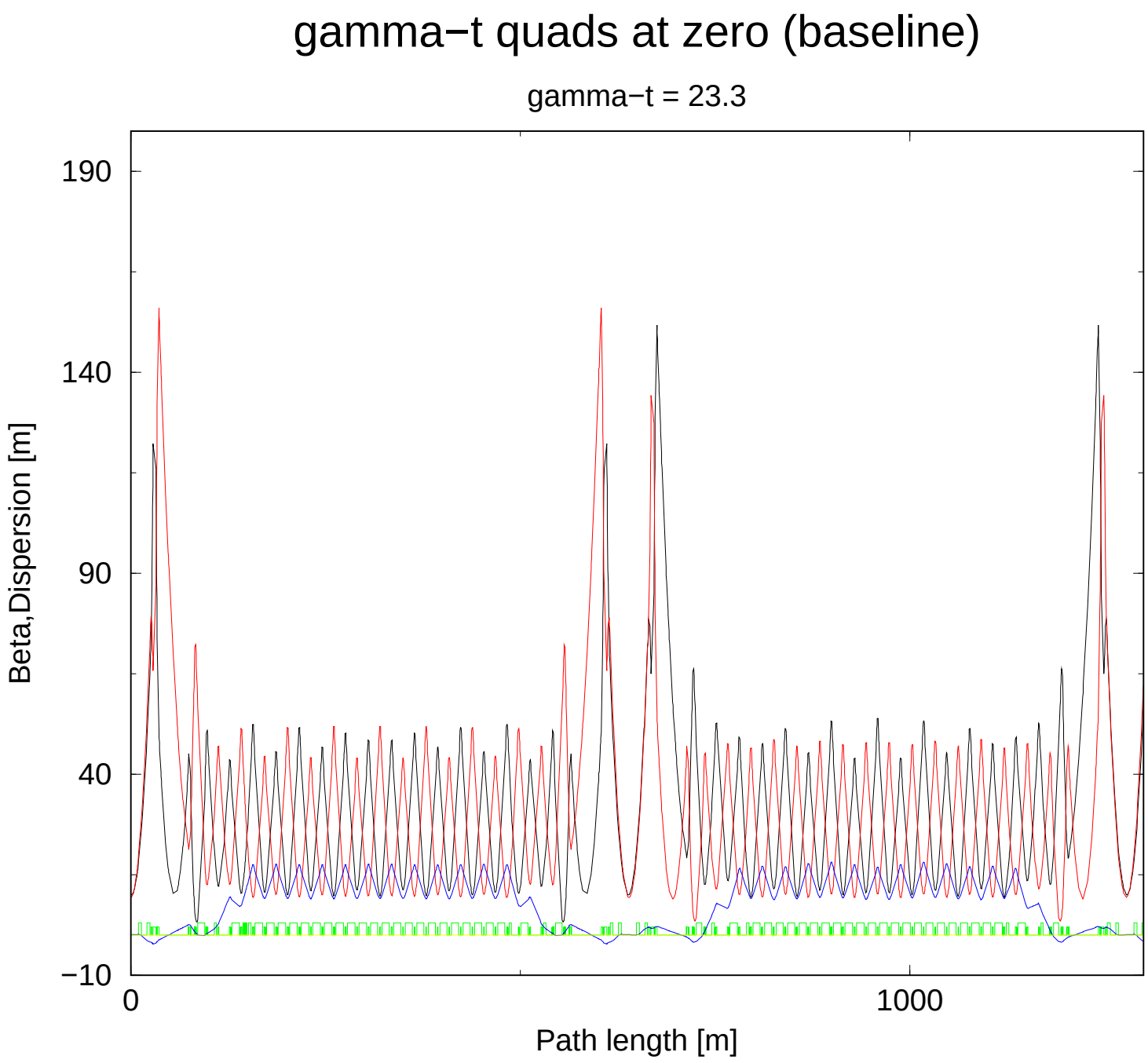
Lowering γ_t at proton injection in RHIC

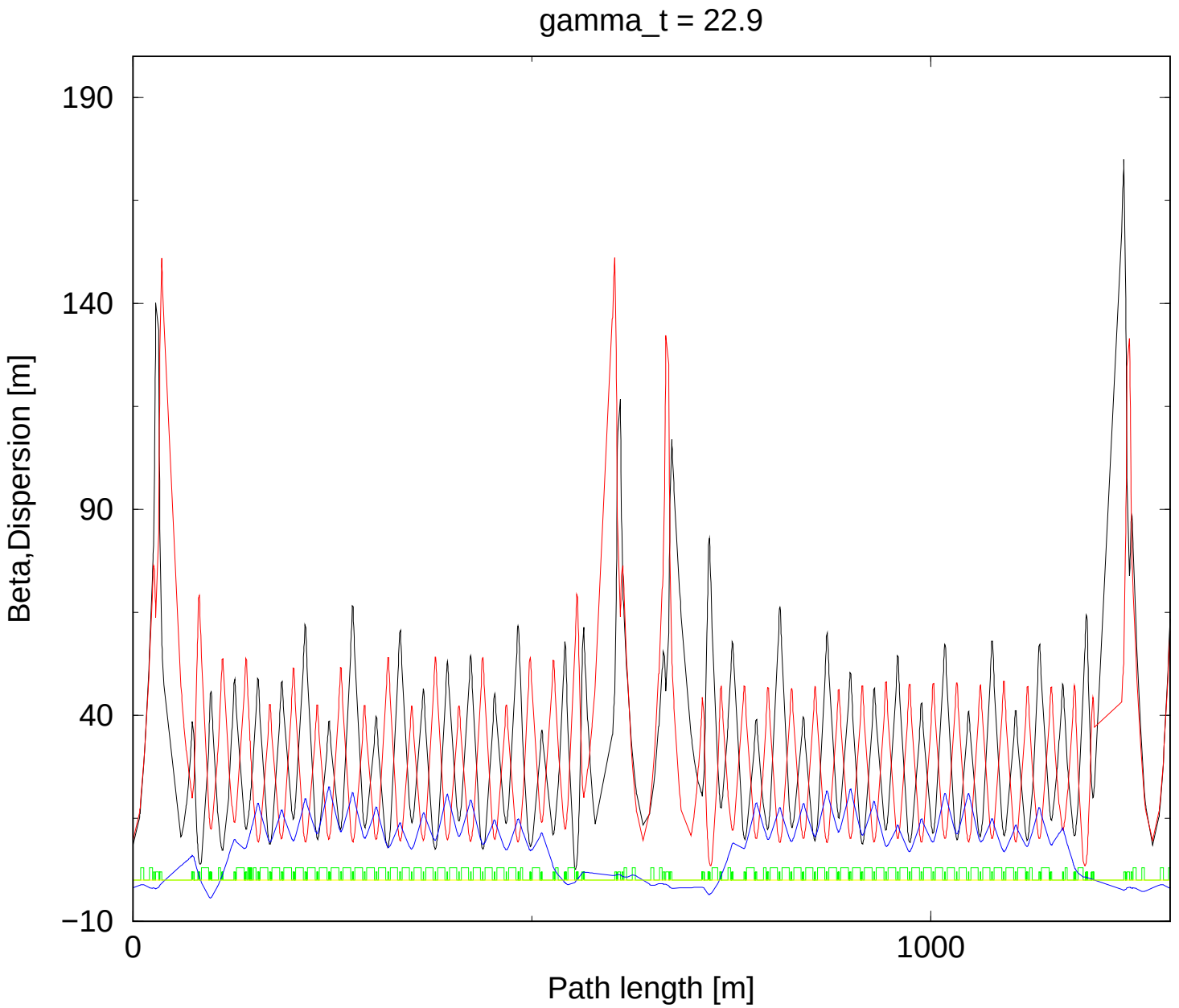
- Goal: lower γ_t by ≈ 0.5 to enable injection at $G\gamma = 45.5$ instead of 46.5

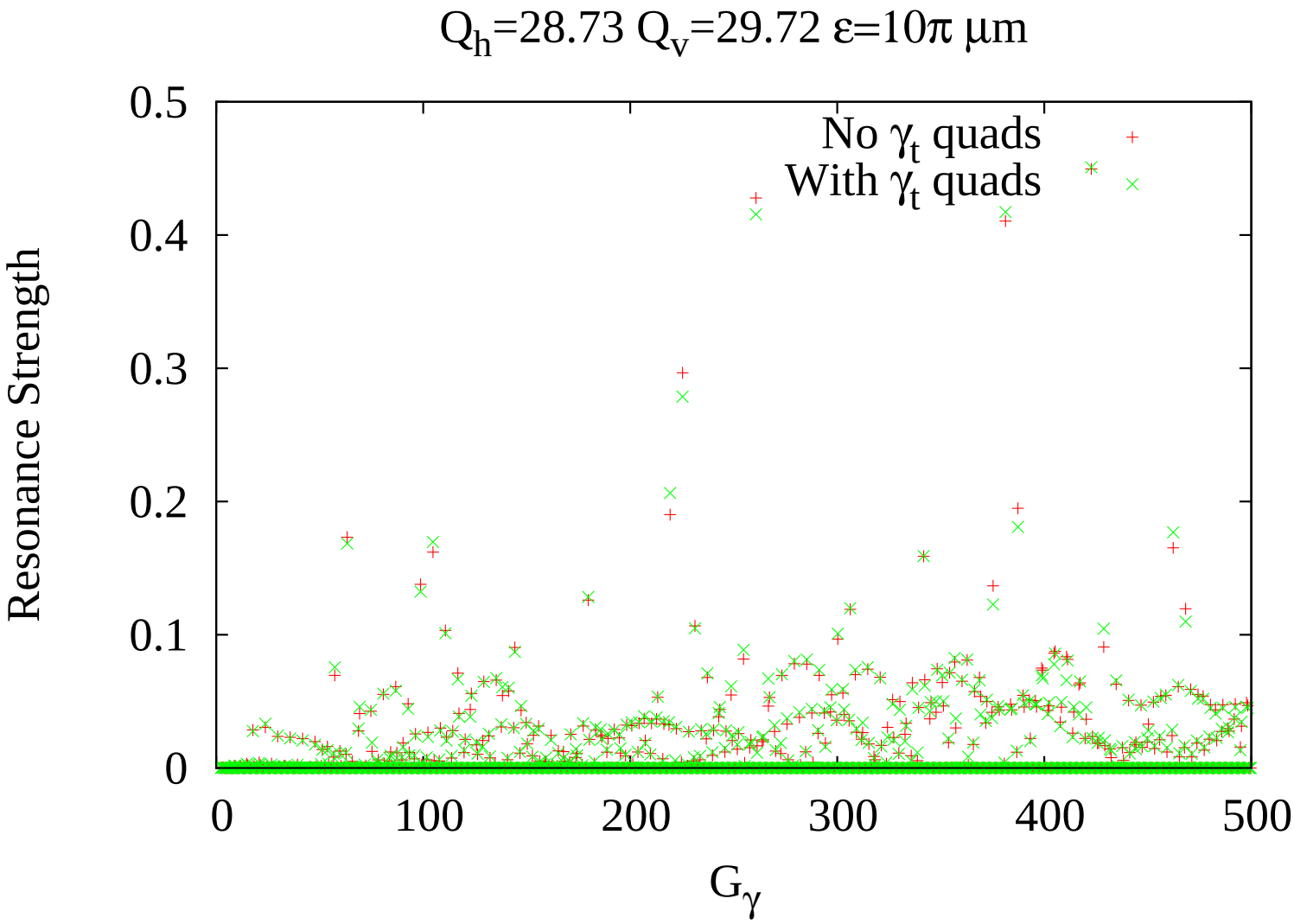
- Four knobs: 2 "gamma-t" families near arc centers, 2 "gamma-tune" families near end of arcs

- Minimize β-beat, restore tunes to 28.73, 29.72


gamma−t quads at zero (baseline)
gamma−t = 23.3
190
140
90
40
−10
0
1000
Beta,Dispersion [m]
Path length [m]

gamma−t quads ON, KGT=KGTI=−1.0, KQTO=2.0, KQTI=0.0

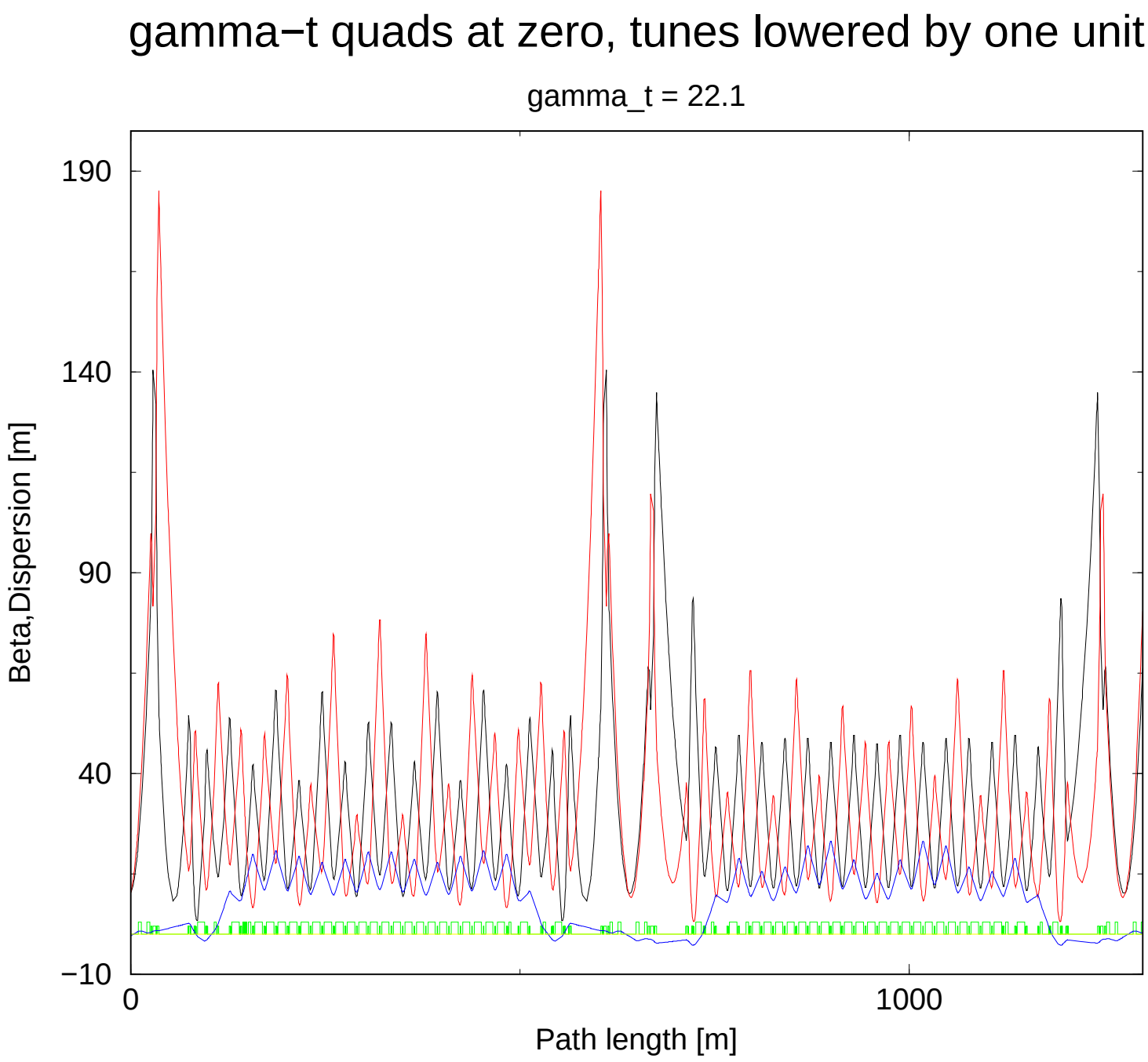



Q_h=28.73 Q_v=29.72 ε=10π μm
No γ_t quads
With γ_t quads
Resonance Strength
0.5
0.4
0.3
0.2
0.1
0
0
100
200
300
400
500
G_γ

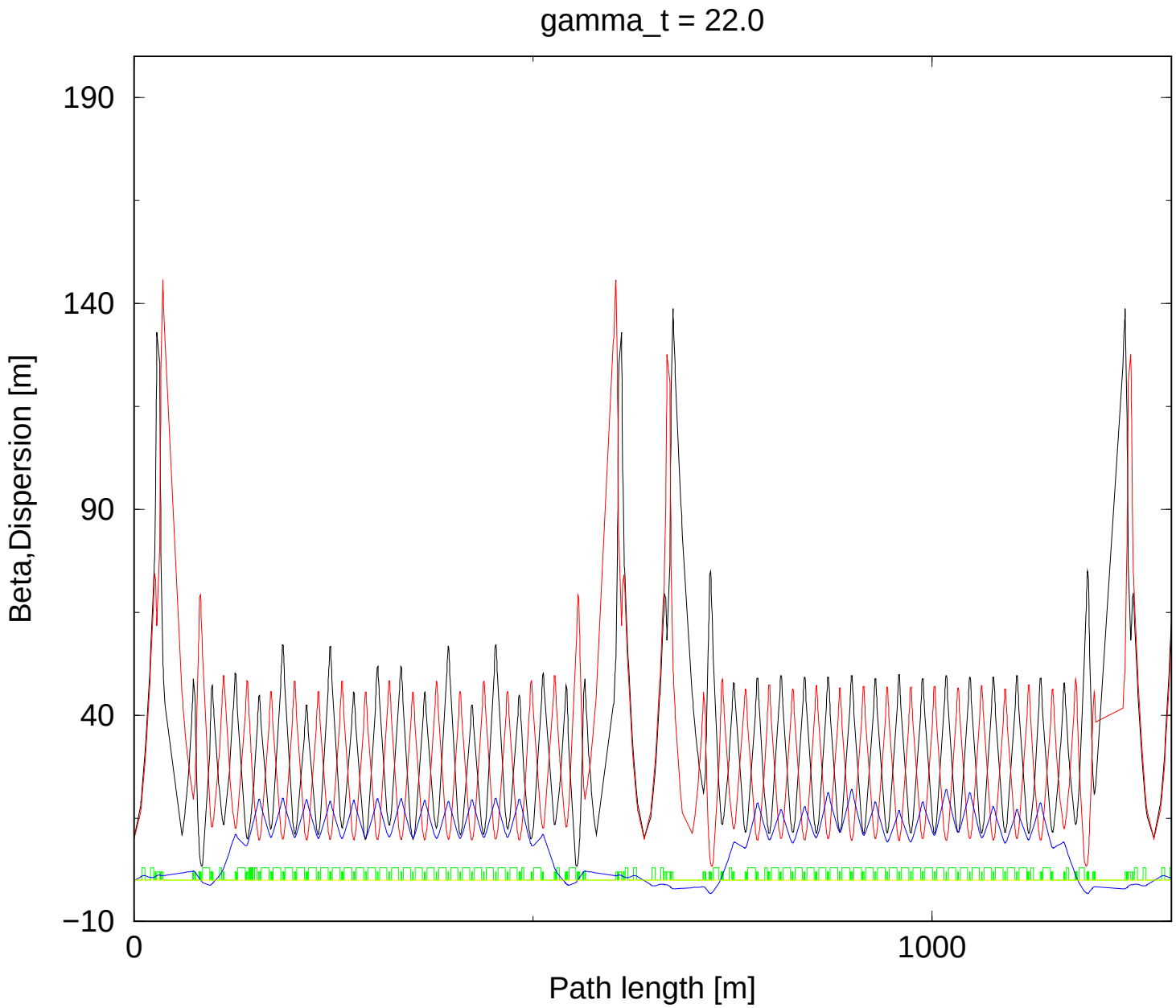
- Lowering γ_t by means of γ_t quads causes considerable β-beat

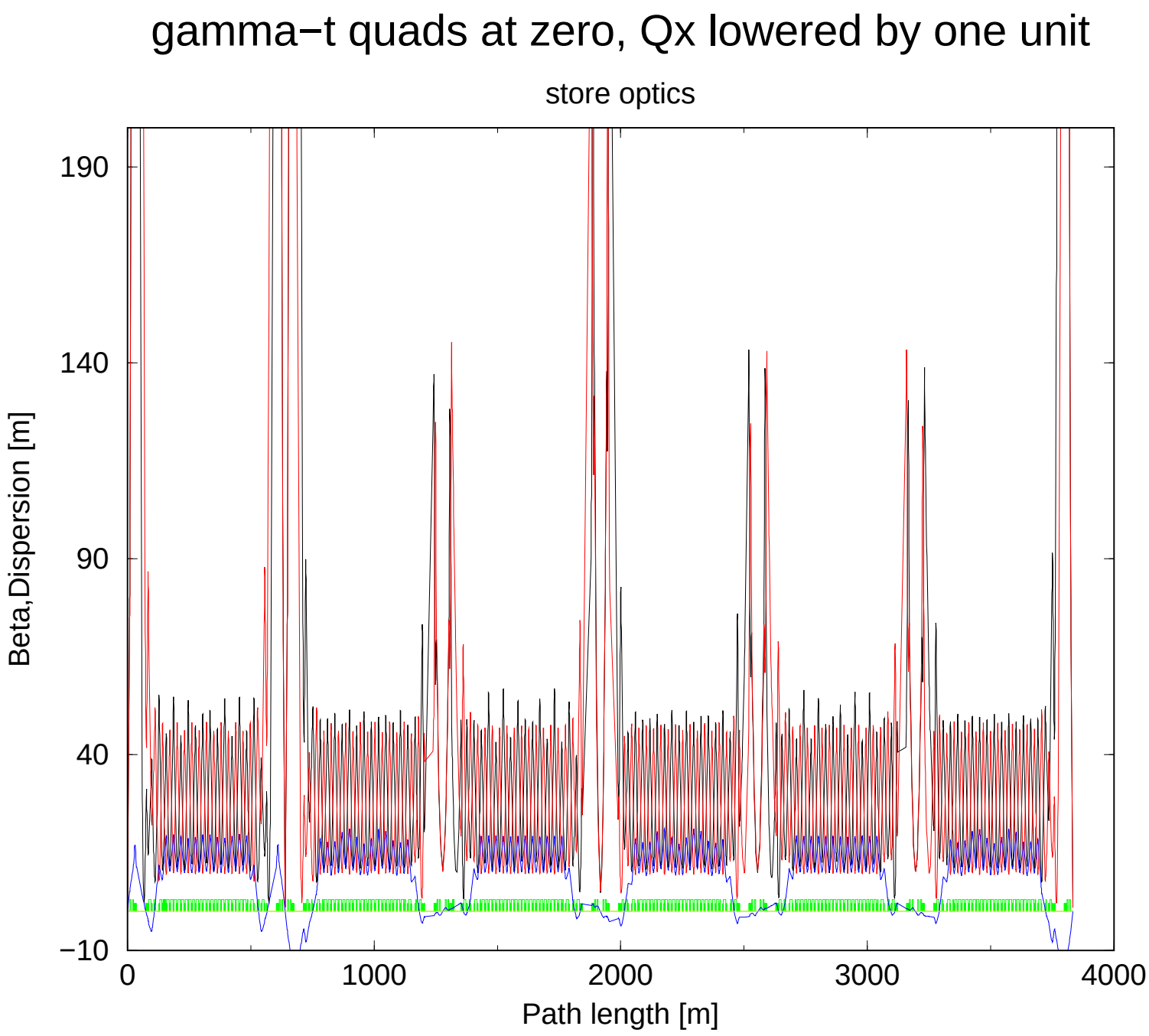
- Re-matching the lattice does not seem easy, since γ_t quads are not located symmetrically within arcs

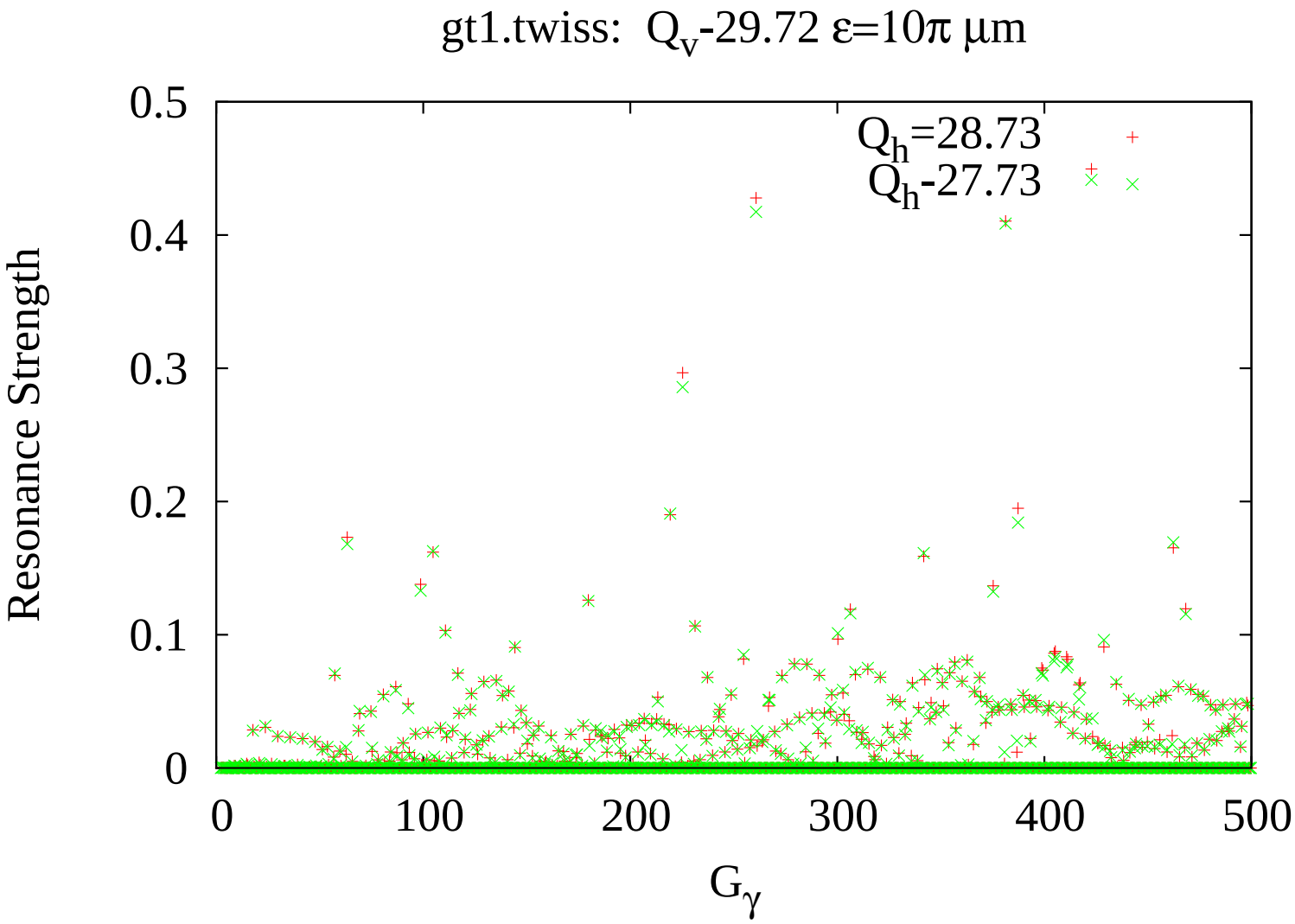
- In a FODO lattice, $\gamma_t \propto Q_x$. What happens if we lower the tune(s) by one unit?


gamma−t quads at zero, tunes lowered by one unit
gamma_t = 22.1
190
140
90
40
−10
0
1000
Beta,Dispersion [m]
Path length [m]

gamma−t quads at zero, only Qx lowered by one unit




gamma−t quads at zero, Qx lowered by one unit
store optics
Beta,Dispersion [m]
190
140
90
40
−10
0
1000
2000
3000
4000
Path length [m]


gt1.twiss: Q_v-29.72 ε=10π μm
Q_h=28.73
Q_h-27.73
Resonance Strength
0.5
0.4
0.3
0.2
0.1
0
0
100
200
300
400
500
G_γ

Conclusion

- The "solution" with γ_t quads at zero, and lowered horizontal tune ($Q_x = 27.73$, $Q_y = 29.72$) has very little β-beat and looks most promising.

- Some "clean-up" rematching may be required, especially at store

- Is there anything that prevents us from lowering the horizontal tune by one unit?